

Census 2000 Testing,  
Experimentation,  
and Evaluation Program

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# Assessing the Impact of Differential Incentives and Alternative Data Collection Modes on Census Response

## FINAL REPORT

This research paper reports the results of research and analysis undertaken by the U.S. Census Bureau. It is part of a broad program, the Census 2000 Testing, Experimentation, and Evaluation (TXE) Program, designed to assess Census 2000 and to inform 2010 Census planning. Findings from the Census 2000 TXE Program reports are integrated into topic reports that provide context and background for broader interpretation of results.

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U S C E N S U S B U R E A U

*Helping You Make Informed Decisions*

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## EXECUTIVE SUMMARY

This report documents the analytical findings from the Nonresponse component of the Response Mode and Incentive Experiment. The purpose of this analysis is to assess the effects of a promised incentive and alternative response mode options on response to the census among a sample of households who failed to return their census forms by April 26<sup>th</sup>, 2000. Note that it is not the intention of this analysis to test incentives or response mode options as nonresponse conversion techniques for the census. Instead, this experiment is designed to test the effect of these factors on response among a group representing those who are traditionally difficult to enumerate.

Results in this paper show that:

- The call-in computer assisted telephone interview mode gained the highest amount of response (7.8 percent) compared to a speech recognition system (4.8 percent) and the Internet (3.7 percent), although the comparison is confounded by the fact that Internet access may be especially problematic for this target population.
- Speech recognition system respondents are significantly younger and reside in households with, on average, fewer people than both mail and CATI respondents. CATI respondents are disproportionately more Black with more households residing in low coverage areas compared to Internet respondents.
- The calling card incentive increased response to the alternative modes by 1.9 percent across all response modes.
- Person 1 in households receiving the incentive tends to be younger than Person 1 in households not receiving the incentive, where the odds of receiving the incentive decrease by 7.2% for each 5-year increase in the age of Person 1.
- Contrary to past survey research, the increase in response due to the incentive is not statistically different in areas with high concentrations of the Black and Hispanic populations and renters (1.9 percent) from other areas (2.0 percent).
- When total response to the experimental second mailing is considered, no significant incentive effect remains. That is, when mail responses are included as respondents, the incentive group (13.8 percent) is no more likely to respond than the non-incentive group (13.2 percent).
- Given these findings, it appears that the incentive merely redirects responses that would have otherwise been obtained by mail to alternative modes.
- Irrespective of the experimental treatments, it is worthwhile to note that around 13

percent participation was obtained from cases that did not initially return the questionnaire or returned the questionnaire late. Replacement questionnaires were not included in the second mailing, implying that respondents who returned a mail form, around 6 to 9 percent, used their original questionnaire mailed in March 2000.

These findings lead to the following recommendations:

- A second mailing containing a request for census participation may in itself be a method for increasing participation in the census and reducing cost associated with personal visit follow-up interviews.
- In order to determine the feasibility of using alternative response modes, further testing is needed in the years to come as Internet access continues to spread across the United States population.
- The incentive does not appear to be effective in recruiting those who otherwise would not participate. However, the incentive may be effective in redirecting response to an alternative response mode in place of costly personal visit interviews.

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## 1. BACKGROUND

The Census Bureau undertakes a program of experimentation during decennial censuses to measure the effectiveness of new techniques, methodologies, and/or technologies in the special environment that a decennial census generates. Results from experiments form recommendations for subsequent testing and ultimately help design the next decennial census. The experiment discussed in this paper is one component of the Response Mode and Incentive Experiment (RMIE), designed to test the effect of an incentive and alternative response mode options on census response. The scope of this paper is the analysis of the Nonresponse component, where the effect of response modes and an incentive on census response is tested among households who did not initially mail back paper forms after the standard Census 2000 mailing. Note that the same treatments are also tested in a first contact with a sample of households. Analysis of the latter component can be found in a report from Westat entitled “Response Mode and Incentive Experiment for Census 2000: Results for Response Rates.” For further details on the design and implementation of the experiment, please see the RMIE Program Master Plan (Malakhoff and Sanders, 2000).

### 1.1 Motivation

Since 1960, most U.S. decennial census data have been collected via the return of a paper questionnaire for households responding to the mailback request (Cohen, White, and Rust, 1999), and via face to face interviews for households that did not mail back census forms. Under standard Census 2000 procedures, all households that did not return a census form by April 18<sup>th</sup>, 2000 were visited or called by a census enumerator who collected information through a Paper and Pencil Interview (PAPI). Six attempts were made by phone and/or visits before proxy data were sought.

Nonresponse Followup (NRFU) procedures, such as the one just described, are extremely costly. For the 1990 census, Dillman *et al.* (1994) estimate that nonresponse followup (with face to face interviews) costed as much as \$17 million for each 1 percent decrease in the mailback response rate. In order to control costs, the Census Bureau has an interest in finding a cost-efficient technique for collecting data that simultaneously encourages cooperation.

### 1.2 Past Research

Groves *et al.* (1992) explore heuristics as well as survey design features such as mode of contact that influence the decision to participate in a survey. “Heuristics” refer to processes that are shortcut means to making a decision. For example, social norms, such as the norm of reciprocation, may influence behavior in the survey context. This norm, which forms the theoretical basis for the use of incentives in surveys, purports that people who receive favors from another will reciprocate by furnishing a favor for that person. Survey researchers often attempt to control features of the survey in order to evoke heuristics that may increase participation.

Two such methods with which researchers have experimented as means of increasing survey participation are alternative response modes and incentives. With respect to response mode, past research suggests that data collection mode can influence survey participation (Groves and Kahn, 1979; De Leeuw, 1993).

The experiment being examined in this paper investigates the effect on participation of an invitation to respond through an alternative mode (phone or Internet), which is quite different from the design of most telephone mode comparisons where a sample case is contacted directly through the mode of interest. In a study similar to the current design, Dillman *et al.* (1994) investigate the effect of an invitation to respond to a census test via the telephone instead of returning a paper form on response. While the addition of the telephone option did not increase initial mailback completion rates, the authors find that a blanket follow-up mailing significantly improved overall completion rates (with increases of 0.2% by mail, 2.6% by telephone), when the follow-up letter contained an invitation to respond by the telephone but did not contain a replacement questionnaire. In another study of mode effects on participation, Clayton *et al.* (1992) find that a speech recognition system was able to retain the same response rate as reverse Computer-Assisted Telephone Interviewing (CATI) and Touchtone Data Entry (TDE) in a longitudinal panel survey of businesses, when businesses that had previously reported by TDE and CATI systems were switched to the speech recognition system. Note that this finding pertains to a business survey where the same factual information is gathered monthly from companies, and therefore may not generalize to one-time surveys of households or persons.

The use of the Internet as a potential response mode for general populations is just beginning to be studied. Most survey research on Internet data collection focuses on the potential for coverage bias due to disproportionately lower Internet access rates among low socioeconomic status (SES) groups compared to high SES groups (Dillman, Tortora, and Bowker, 1998; Smith, 1997; Sweet and Russell, 1996). Mode studies among populations with Internet coverage suggest that web surveys obtain lower response than paper surveys (Kwak and Radler, 2000); however, embedding a web option into a paper survey can increase total response (Elig, Quigley, and Hoover, 2000).

In addition to alternative response modes, incentives are another method tested as a means of increasing response. Numerous empirical studies lend support for the conclusion that incentives increase response rates (Singer, Van Hoewyk, Gebler, Raghunathan, and McGonagle, 1999; Abreu and Winters, 1999; Shettle and Mooney, 1999; Baumgartner and Rathbun, 1996; Kulka, 1994; Church, 1993; Heberlein and Baumgartner, 1978). Recently, incentives research has shifted focus to the use of incentives for nonresponse conversion. To date, much of the research on differential incentives has focused on the public's perception of the equity of this practice and their behavior as a result of this realization (Groves, Singer, Corning, and Bowers, 1999; Singer, Groves, and Corning, 1999; Singer, forthcoming). With respect to the efficacy of incentives for refusal conversion, Kulka (1994) and Abreu *et al.* (1999) find that delaying the use of incentives to later stages of contact can be quite effective as a nonresponse conversion technique.



These findings could, however, reflect the influence of incentives on typical survey and census nonrespondents, who are often disproportionately non-white and of lower SES than respondents (Cecco,1994; Word,1997; Singer, forthcoming). Kulka finds evidence of more pronounced incentive effects among these groups, which may be at least partly due to the higher utility of gifts/money to these persons. Yet, after a comprehensive review of the literature in this area, Kulka (1994) admits that “none of the literature reviewed specifically addresses their [incentives] efficacy with hard core refusals or those who are truly difficult or impossible to interview.” The questions remain: Do incentives encourage participation among typical groups of nonrespondents? Moreover, are differential incentives more effective in increasing response within subgroups of low SES persons compared to high SES persons?

In addition to their effect on response, some researchers have studied the effect of incentives on sample composition and consequently, the potential for nonresponse bias. Shettle *et al.* (1999) report mixed findings, with some studies showing differential motivating effects of incentives (Singer, Van Hoewyk, Gebler, Raghunathan, McGonagle,1999; Willimack, Schuman, Lepkowski,1995; Dillman,1996; Baumgartner and Rathbun,1996) while others reveal no differential effects (Berry and Kanouse,1987; Hopkins, Hopkins, and Schon,1988). Other researchers, to whom data for nonrespondents is unavailable, have compared the characteristics of incentive respondents and non-incentive respondents in an effort to determine if incentives have the potential to change the demographic distribution of the respondent population (James and Bolstein,1990). Through these studies, there is some evidence to suggest that incentives are effective in recruiting younger people (Dillman,1996) and those who are typically underrepresented in surveys such as low income and non-white groups (James and Bolstein,1990; Singer,forthcoming).

Note that in the articles reviewed above, incentives are tested in survey environments in which response is voluntary. Census 2000 marks the first time that incentives have been tested in a U.S. decennial census, where response, as explicitly stated on the envelope containing the census form, is mandated by law. Therefore, it is difficult to fully assess the extent to which the past results may generalize to the census, due to the differences in the legality of response and the visibility of a decennial census. In light of these differences, the research question at hand becomes narrower: What is the effect of incentives on response among typical census nonrespondents where response is mandated by law?

Given the potential for increased participation, the Census Bureau designed an experiment to determine the effect of alternative response modes and incentives on census response among an initial nonrespondent group. Note that it is not the intention of this experiment to test nonresponse conversion incentives as a possible method for the 2010 census. Instead, this experiment is designed to test the effect of these factors on response from groups who are traditionally difficult to enumerate. The Census Bureau hopes to answer the following questions with results from this experiment:

- Does an incentive encourage census response among those who are difficult to

enumerate?

- Do incentives encourage census response via alternative data collection modes? If so, in what mode is the effect of the incentive most pronounced?

### 1.3 Purpose of this Experiment

Insight from this experiment will allow an investigation as to whether census response among typical census nonrespondents can be increased through the use of incentive or alternative response modes. The purpose of this experiment is three-fold:

- To measure the effect of an incentive on census response by alternative response modes for typical census initial nonrespondents.
- To measure the effects of alternative electronic response mode options on census response for initial census nonrespondents.
- To measure differences in the effectiveness of an incentive on census participation across the various response mode options and subpopulations that historically differ with regard to census participation.

### 1.4 Hypotheses

In this experiment, the effect of an incentive is tested within three response modes: *Reverse CATI*, where a household member is asked to call a toll free number to report short form information to an interviewer, *Automated Spoken Questionnaire (ASQ)*, where the respondent is asked to call a toll free number that is connected to a speech recognition system that processes short form spoken information into text, and the *Internet*, where respondents are presented with a URL in the letter sent with the experimental packages. Certain *a priori* hypotheses were developed in light of past survey research.

First, we hypothesized that response to the CATI and ASQ modes will be significantly higher than response to the Internet. Although there is no evidence to suggest that initial nonrespondents prefer the telephone over the Internet, Internet accessibility limitations in this population may suppress the use of the Internet as a tool for providing census data since the typical census nonrespondent universe is one that resembles the universe of households without Internet/computer access (Cecco,1994; Newburger,1997; Word,1997).

Second, we hypothesized that the incentive will increase response compared to no incentive among initial census nonrespondents, with a stronger effect in areas expected to contain a large concentration of non-white renters (low census coverage areas) compared to other areas.

Similarly, it is hypothesized that the group of respondents receiving the incentive will be younger with higher concentrations of non-whites and renters compared to the group of

nonincentive respondents based on past research findings.

With respect to mode interactions, it is expected that the effect of the incentive will be stronger within the self-administered modes compared to CATI since incentives tend to be most effective in the absence of other motivating factors (in this case, the interviewer) that might elicit response (Singer, forthcoming; Baumgartner and Rathbun, 1996). However, Internet accessibility limitations may mask the effect of the incentive on response in the Internet mode. Therefore, the effect of the incentive will be more pronounced in ASQ than CATI and the incentive effect in ASQ and CATI will be greater than the effect in the Internet.

## 2. METHODOLOGY

### 2.1 Experimental Design

This experiment includes 19,639 households that were randomly pre-assigned to six nonresponse experimental treatment groups prior to mailout. On March 13<sup>th</sup>, 2000, standard Census 2000 questionnaires were mailed to these households. Any household that did not return a census form by April 26<sup>th</sup>, 2000 and was eligible for Nonresponse Followup<sup>1</sup> formed the target population for this study. There were 12,787 mailback responses obtained out of 19,639 forms mailed, less 1743 undeliverable forms. The response rate as of the date at which the nonresponse universe was identified (4/26/00) was 71.5% after removing undeliverables from the denominator and recoding blank<sup>2</sup> forms returned as nonrespondents.

The 6,130 households eligible for the nonresponse experimental treatments fell into six alternative mode and incentive groups in the manner described in Figure 1. Alternative response modes refer to data collection modes other than mail given as optional methods of replying to Census 2000. The alternative response mode options are (Malakhoff and Sanders, 2000):

1. ***Reverse Computer-Assisted Telephone Interview (CATI)***: Households are encouraged to call a toll free number on a brochure and in a cover letter included in the second mailing to report their census data.

Respondents who call this number are connected to a live interviewer who will ask short form

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<sup>1</sup> 662 nonrespondent cases not included in the nonresponse universe are ineligible for follow-up using census definitions given in DSSD CENSUS 2000 PROCEDURES AND OPERATIONS MEMORANDUM #BB-4R and DSSD CENSUS 2000 PROCEDURES AND OPERATIONS MEMORANDUM #D-6.

<sup>2</sup> Questionnaires are considered blank if they contain less than 2 completed items among household count, tenure, and all person items under census procedures given in DSSD CENSUS 2000 MEMORANDUM SERIES: #K-3 from Hogan to Miskura and Longini. Due to intense labor involved in replicating the blank form algorithm, a simpler technique is used for all Census 2000 experiments. Forms are blank when the number of completed items for the household, person 1 and person 2 is less than two.

questions. Spanish interviews are permitted with this technology<sup>3</sup>.

2. ***Automated Spoken Questionnaire (ASQ)***: Households are encouraged to call a toll free number in a brochure and letter sent with the second mailing which is, unbeknownst to the respondent, connected to a computerized speech recognition system that collects short form data by processing spoken replies into text. This technology is available in English only.

Callers who experience problems with the ASQ system are automatically transferred to an interviewer who can collect the data via CATI. Transfers to CATI from ASQ can occur at any point in the interview<sup>4</sup> for many reasons including problems with speech recognition, soft-spoken replies, foreign noises (cough, sneeze), or failure to provide data at a specified time.

3. ***Internet***: Households are presented with an Internet Uniform Resource Locator (URL) in a brochure and letter sent in the second mailing. The respondent enters short form data at this official Census Bureau Internet site after submitting a legitimate 22 digit Census ID indicating that the household is an experimental case. For security purposes, users with less than 128 bit encryptions are asked to check a security warning box acknowledging that submitted data may not be secure from third parties since the encryption level is lower than recommended by census. The Internet form is only available in English.

Every household, regardless of treatment group, was presented with an Operator Assistance toll free number to which they could direct questions. As a courtesy, the operators collected census data for the cases that preferred to provide their information in this manner. The operators could also activate the calling cards for these respondents even if CATI was not the suggested mode for the panel into which the household fell.

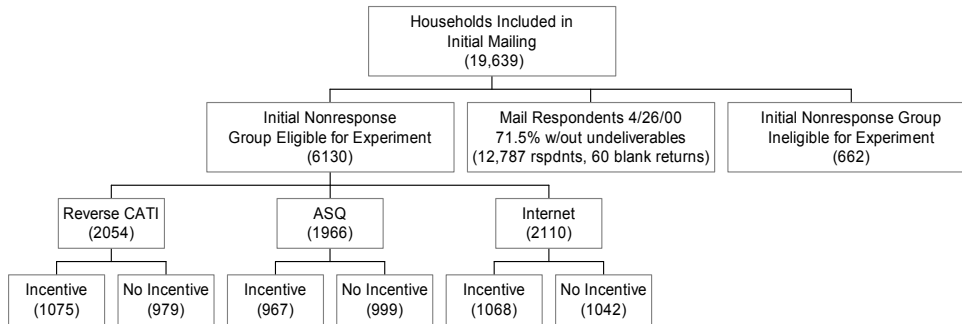
Within each mode, households were randomly split into two groups prior to the second mailing, where one-half of the sample received the incentive, and one-half did not. The experiment has a 3x2 factorial design in which an incentive is fully crossed with three alternative response modes.

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<sup>3</sup> There was only one Spanish interview taken during this experiment. This call came through the Operator Assistance number from a respondent in the Internet with incentive group, and therefore will not be counted as a respondent in the mode response rates in order to eliminate any confounding effects from the allowance of Spanish speaking households in CATI.

<sup>4</sup> ASQ assigned cases that transferred to CATI before providing any information have only CATI records on the data file (18 cases) and are treated as CATI responses. Cases that completed at least some portion of the questionnaire in ASQ before transferring to CATI have both ASQ and CATI records (5 cases). In order to isolate the effect of the treatment mode, the record corresponding to the assigned mode for the panel is retained when duplicate records are present, regardless of whether that record is considered blank by census definition. Several cases have duplicate ASQ responses. When discrepancies between the records exist, the most complete record is retained.

**Figure 1. Treatment Groups and Sample Sizes in the Experiment** (Mailout Sample Sizes in Parentheses)



The incentive is a calling card worth 30 minutes of free long distance service in the United States. The card is activated only after the response is obtained via the assigned mode for the treatment group (Malakhoff and Sanders,2000). The card is attached to the front of a brochure promoting the incentive opportunity in the second mailing. In addition to a unique calling card number and standard Census 2000 logos, the card also contains the assigned telephone number or URL for the mode through which the household is required to reply in order to have the card activated.

The calling card was selected primarily because it fit nicely with the theme of the experiment. That is, the calling card promotes phone usage, similar to four treatment groups in the experiment which persuade the respondent to use the telephone to reply to the census. Moreover, the calling card was selected under the assumption that all sampled households have access to telephones for the purpose of making outgoing calls.

All experimental packages were mailed to the nonresponding households on May 2, 2000. These households had the option of answering Census 2000 via the standard paper questionnaire originally sent to the household with the initial mailing; however, replacement questionnaires were not included with the second mailing and calling cards were not activated for households that returned paper questionnaires (Malakhoff and Sanders,2000).

## 2.2 Sample Design

The sample was selected from the July 1999 version of the Decennial Master Address File mailout/mailback universe of 92,575,792 addresses as of September 9, 1999, which excludes samples for the Accuracy and Coverage Evaluation (A.C.E.) listing as well as congressional addresses. The population of inference is restricted to the population in the mailout/mailback areas. Mailout/mailback areas contain housing units with city-style addresses and comprise roughly 80% of the United States for Census 2000. List/enumerate and update/leave areas, omitted from this frame, are typically more rural than mailout/mailback areas.

The original 19,639 households are proportionately allocated to two strata that reflect anticipated

differences in the race and tenure composition of the population and, based on previous census experience, differences in the Census 2000 mail return rates. Strata are formed from 1990 census tract level race and tenure data and are denoted as low and high coverage areas (LCA and HCA respectively). The LCA stratum is expected to contain a much higher proportion of Black and Hispanic populations and renter-occupied housing units than the HCA stratum. The HCA stratum contains the remaining addresses and comprises approximately 81% of the total mailout/mailback universe at the time the sample was selected.

All figures in this report are weighted to adjust the inference back to the full frame given the stratification. The inverse of the original sampling interval for each strata within a treatment group is the weight for each case contained in that group and stratum.

### 2.3 Effective Sample Size

The mailout sample size for each treatment group was around 1000 addresses (see Table 1 for more detail). The United States Postal Service returned about seventeen percent of experimental forms that were mailed in each treatment group as Undeliverable as Addressed (UAA). These cases are excluded from the denominator of the response rates since they never had the opportunity to respond. For this experiment, higher undeliverable rates than Census 2000 are expected since undeliverable packages from the initial mailing are not excluded from the nonresponse universe. Multiple comparisons of weighted undeliverable rates confirm that the rates do not differ significantly across treatment groups.

**Table 1. Sample Sizes for the Second Mailing, Number of Undeliverable Packages, Counts of Late**

**Mail Returns, Final Sample Sizes for the Analysis by Strata, and Counts of Blank Returns for the Treatment Groups**

<b>Mode</b>	<b>Treatment Groups</b>	<b>Sample Size for Second Mailing</b>	<b>UAA (%)</b>	<b>Late Mail Returns (&lt;=5/3/00)</b>	<b>Final High Coverage Area sample size (excludes undeliverables, late mail returns)</b>	<b>Final Low Coverage Area sample size (excludes undeliverables, late mail returns)</b>	<b>Blank Forms</b>
CATI	Incentive	1075	172 (16.4)	28	628	247	3
	No incentive	979	171 (18.0)	27	579	202	1
ASQ	Incentive	967	186 (19.8)	28	547	206	4
	No incentive	999	170 (17.5)	27	593	209	0
Internet	Incentive	1068	168 (16.2)	33	645	222	3
	No incentive	1042	162 (16.0)	30	631	219	0

Note that certain cases in the nonresponse universe were found to have returned their census forms after the April 26 cutoff. Since experimental packages were mailed on May 2, 2000, any case returning a census form by mail prior to May 4 will be excluded from the analysis since these cases are not true nonrespondents. A total of 173 out of the 6130 initial nonresponding households, including 11 cases that provided both a late mail return and an electronic return, are eliminated under this criteria<sup>5</sup> (see Table 1).

Due to security concerns, census web administrators insisted that the Internet data collection site for this experiment remain active for no longer than one month. Therefore, the census Internet site was taken down on June 3 at midnight eastern time. The ASQ and CATI capabilities were shutdown on June 9.

Mode response rates presented throughout this report reflect responses obtained via electronic

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<sup>5</sup> The analysis in Table 4 was conducted with the inclusion of the late mail returns. The conclusions did not change with the addition of these cases, with the exception of the difference between the ASQ incentive and non-incentive panel with overall response rates. The difference between these panels is not significant when late mail returns are considered.

modes before June 4.

## 2.4 Measurements

Response rates are a measure of respondent behavior with regard to the return of the questionnaire. Undeliverable form information, used to distinguish cases that received the experimental package, was gathered through a manual check-in of returned experimental packages<sup>6</sup>. There are two response rates:

1. *Mode specific response rate*: The mode specific response rate is defined as the number of non-blank questionnaires returned by the mode assigned to the treatment group divided by the number of experimental forms mailed out less undeliverable forms. The numerator contains only those responding households that provided their data via the mode requested for their panel.
2. *Overall response rate*: The overall response rate is defined as the number of non-blank questionnaires returned by any mode<sup>7</sup> (mail, CATI, ASQ, Internet) for the treatment group divided by the number of experimental forms mailed out less undeliverable forms.

Each rate will be presented for the various experimental treatments with a focus on the mode specific response rate in order to assess the effect of the incentive in redirecting response to a new mode, as well as the efficiency of the data collection technologies. The mode specific rate measures the rate at which households performed the prescribed behavior in order to receive the incentive, when households are eligible for the incentive. This rate allows pure comparisons of the efficiency of the data collection systems, since mode switches (CATI rollovers or Operator Assistance calls that resulted in CATI interviews) are not counted as respondents.

Overall response rates reflect total response to the second mailing, including mail returns which were received up until June 14, 2000. Comparisons of overall response rates between the incentive and no incentive group will reveal whether the incentive increased total response to the second mailing compared to no incentive.

## 2.5 Analysis

The analysis of the experimental treatments is conducted by measuring the pairwise differences

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<sup>6</sup> UAAs from the initial mailout in this experiment were delivered to headquarters from the NPC after form processing. We cannot be sure that we received every UAA.

<sup>7</sup> The overall response rate includes paper forms received after the electronic modes were shut down and therefore cannot be directly compared to the mode specific response rate. Since mail check-in dates are dependent upon mail delivery speed as well as check-in delays due to back logs, it is not possible to control the date of the return to identically match the date for the electronic returns.



in the response rates among the treatment groups and by modeling the mode specific response rate using logistic regression. For pairwise comparisons involving more than two levels of a treatment, the Bonferroni multiple comparison procedure is carried out so that statements about the entire family of pairwise comparisons are made while maintaining a 90 percent simultaneous confidence level. Interpretation of the logistic regression results uses parameter estimates of significant experimental treatments to assess the magnitude of the impact of the treatment on a household's odds of responding to the census in the presence of other treatments. Additionally, tests of differential incentive effects among other experimental treatments and populations will take the form of interaction terms in logistic regression models. All analyses are conducted so that statements about the significance of treatment effects can be made with a 90 percent confidence level (the Census Bureau standard).

Note that item nonresponse analysis was originally planned as a part of this experiment. Due to extremely low item nonresponse, analyses of this nature were not supported by the data.

## 2.6 Variance Estimation

In order to take into account the stratified sample design, WesVarPC version 3 is used to compute standard errors for all estimates and models. A jackknife replication methodology using random groups was used to estimate standard errors. Since there is no clustering in the sample and only two strata to which the sample is allocated, 100 element replicates were formed within each stratum by consecutively numbering households from 1 to 100, after the households were sorted in the same order in which the sample was selected. Due to smaller sample sizes, 25 replicates were formed within each strata to model the odds of respondents receiving the incentive on demographics of the nonresponse conversion households.

Quality assurance procedures were applied to the design, implementation, analysis, and preparation of this report. The procedures encompassed methodology, specification of project procedures and software, computer system design and review, development of clerical and computer procedures, and data analysis and report writing. A description of the procedures used is provided in the 'Census 2000 Evaluation Program Quality Assurance Process.'

## 3. LIMITATIONS

### 3.1 Population Coverage

The sampling frame in this experiment includes only mailout/mailback areas with city-style addresses, with the exclusion of Accuracy and Coverage Evaluation (A.C.E.) initial listing samples and congressional addresses. Moreover, addresses in mailout areas added through coverage improvement programs between the printing of address labels in July 1999 and the initial mailout in March 2000 are not included in the sampling frame which may result in a slight undercoverage of the target population.

Furthermore, non-English speaking households (with the exception of Spanish speaking

households in CATI) are disproportionately underrepresented in this experiment since the experimental questionnaires and forms are only available in English.

### 3.2 Causal Assumption about the Effect of the Treatments

In reporting response rates for the treatment groups, a critical causal assumption is made regarding respondent behavior. The assumption is that each respondent who provides data has been exposed to the written encouragement and/or incentive, and that the respondent's behavior is directly motivated by the treatment. There is no way to test this assumption, in light of the data collected.

## 4. RESULTS

### 4.1 What is the effect of the mode options on response?

Past research has shown that data collection mode can influence participation (de Leeuw, 1992; Groves and Kahn, 1979). The initial hypothesis regarding the effect of mode predicted higher response to the telephone (ASQ and CATI) modes as compared to the Internet, due to the expectation of Internet accessibility limitations among this population rather than mode preference. Mode specific response rates are computed across the incentive groups and differences are computed among each mode in Table 2.

**Table 2. Mode Specific Response Rates(Sample Sizes) and Response Rate Differences Among Modes and Across Incentive Groups by Census Coverage Area\*\***

Mode	Full Population		High Coverage Areas		Low Coverage Areas	
	Mode Specific	Difference	Mode Specific	Difference	Mode Specific	Difference
CATI	7.8% (1656)	<b>2.9%*</b>	8.6% (1207)	<b>3.4%*</b>	5.6% (449)	1.7%
ASQ	4.8% (1555)		5.2% (1140)		3.9% (415)	
CATI	7.8% (1656)	<b>4.1%*</b>	8.6% (1207)	<b>4.1%*</b>	5.6% (449)	<b>4.2%*</b>
Internet	3.7% (1717)		4.5% (1276)		1.4% (441)	
ASQ	4.8% (1555)	1.2%	5.2% (1140)	.7%	3.9% (415)	<b>2.5%*</b>
Internet	3.7% (1717)		4.5% (1276)		1.4% (441)	

\* statistically significant when the familywise error rate is controlled using Bonferroni at  $\alpha=.1$  for all comparisons

\*\* Note that the numbers in the difference column may be slightly different from the computations using the rates presented due to rounding error.

In accordance with the hypothesis, CATI elicits consistently higher response than the Internet, regardless of which population is studied. The disagreement with the hypothesis is related to the fact that the ASQ did not perform as well as expected. CATI obtains higher response than ASQ, and ASQ does not gain higher response than the Internet (with the exception in low coverage areas, see below). There is some evidence to suggest that these findings may be due to difficulties in using the ASQ. Feedback from census ASQ testers revealed that the system was somewhat difficult to use. The level of response does not differ between CATI and ASQ when calls and rollovers to CATI are permitted from households assigned to ASQ, suggesting that usability issues rather than mode preference are responsible for the ASQ and CATI difference.

Looking at the effect of response mode alternatives in low coverage areas, the results agree with the expectation that CATI and ASQ gain equal levels of response and that that level is higher than that of the Internet. The significant differences between CATI or ASQ response and the

Internet may suggest that Internet access is especially low among this subpopulation which is expected to resemble demographically the population without Internet access (Newburger,1997).

In order to determine if the alternative modes attract different respondents, demographic characteristics of all respondents were compared by modes in Table 3. There is some evidence from past research indicating that older persons are less likely to respond over the telephone (Groves and Couper, 1998). Note that, in the absence of information regarding who completed the questionnaire in the household, Person 1 characteristics are used to describe the respondent. Admittedly, past research indicates that Person 1 is not the respondent roughly 30% of the time (DeMaio and Bates,1990). However, no differential effects regarding this assumption are expected across response modes.

**Table 3. Demographic Comparisons of Nonresponse Conversion Households by Actual Response Mode Used**

Factor	Response Mode Used			
	Mail	CATI	ASQ	Internet
Mean age of Person 1	50.1	44.7	37.7	40.5
Percent Person 1 Black	12.8%	16.7%	10.6%	5.1%
Percent Person 1 Hispanic	7.8%	8.3%	3.6%	5.1%
Percent Renter-occupied Households	38.9%	42.0%	43.2%	42.4%
Percent Households in LCA	17.0%	19.7%	17.8%	8.5%
Mean Household Size	2.70	2.73	2.04	2.58

Cross mode differences for each factor are compared while controlling the familywise error rate at  $\alpha = .1$  using the Bonferroni MCP. The results reveal that ASQ respondents are significantly younger and reside in households with, on average, fewer people than both mail and CATI respondents. CATI respondents are disproportionately more Black with more households residing in low coverage areas compared to Internet respondents.

Given that Internet access is lower among low socioeconomic groups, it is not surprising to find that Internet respondents tend to be less Black and more likely to reside in high coverage areas than CATI respondents. The difference between ASQ and CATI are somewhat unexpected, especially with respect to household size. It is possible that respondents with large households who used the ASQ realized very quickly that the system was somewhat time consuming, and quickly disconnected from the computer whereas CATI respondents had a harder time disconnecting due to the interaction with the interviewer. Moreover, the difference in age between CATI and ASQ respondents may be due to more familiarity with newer technologies on the part of younger persons compared to older respondents. These suggestions are merely

anecdotal and there are no data to support or disconfirm these suggestions.

#### 4.2 What is the effect of the incentive on response?

Past research provides overwhelming evidence that incentives increase response compared to no incentives, especially among populations that are poor with a high concentration of non-whites (Kulka, 1994; Singer, forthcoming) and in the absence of other motivating factors (Singer, forthcoming). Given past findings, it is expected that the incentive will increase response, with a larger effect in low coverage areas compared to high coverage areas. Similarly, the incentive effect will be greater in the ASQ mode due to the absence of an interviewer compared to CATI, and in CATI compared to the Internet due to Internet accessibility barriers masking the incentive effect. Moreover, it is expected that incentive respondents will be younger and more racially and ethnically diverse than non-incentive respondents.

In order to assess the effect of the incentive within and across response modes, response rates in Table 4 were computed for each experimental treatment along with pairwise differences between the incentive and non-incentive groups within and across each response mode.

**Table 4. Mode Specific and Overall Response Rates, Sample Sizes, and Pairwise Differences between Incentive and No Incentive Groups within and across Response Modes**

Mode	Mode Specific Response Rate		Difference	Overall Response Rate		Difference
	Incentive	No incentive		Incentive	No incentive	
CATI	8.8% (875)	6.7% (781)	2.1%	14.4% (875)	14.5% (781)	-.1%
ASQ	6.4% (753)	3.4% (802)	<b>3.0%*</b>	15.2% (753)	11.9% (802)	<b>3.3%*</b>
Internet	3.9% (867)	3.4% (850)	.5%	11.9% (867)	13.2% (850)	-1.3%
Total	6.4%	4.5%	<b>1.9%*</b>	13.8%	13.2%	.6%

\* indicates statistical significance when  $\alpha=.1$ .

Results in the table above lend support for the hypothesis that the incentive increases mode specific response compared to no incentive. Discussion of the overall response rate comparisons is located in section 4.4.

Table 5 presents logistic regression coefficients when the mode specific response rate is regressed on the experimental treatments as well as some control variables. Logistic regression analysis allows an assessment of the effect of the treatments on response in the presence of other

treatments or control variables. For example, the Simple Model investigates the effect of the incentive on response while controlling for strata (as a proxy for socioeconomic status) under the assumption that the effect is consistent within each response mode. The purpose of the models with the interaction terms is to determine if the incentive effect differs among strata and response modes. The Incentive-Strata Interaction Model helps determine whether the effect of the incentive on response differs based on the stratum to which it is administered. Lastly, the Incentive-Mode Interaction Model relaxes the assumptions of the Simple Model to test whether the incentive (versus no incentive) increases response disproportionately among the response modes.

**Table 5. Logistic Regression Coefficients Predicting the Log Odds of Responding to the Census through the Assigned Mode**

Predictor Variables	Simple Model	Incentive-Strata Interaction Model	Incentive-Mode Interaction Model
<b>Mode:</b>			
Internet = 1	-.302*	.012	.013
CATI = 1	.496*	.717*	.717*
ASQ = 1	--	--	--
<b>Incentive:</b>			
Incentive = 1	.374*	.888*	.679*
<b>Census Area (strata):</b>			
High Coverage Area = 1	.567*	.725*	.568*
<b>Interactions:</b>			
CATI * Incentive		-.365	-.364
Internet*Incentive		-.534*	-.537*
Incentive*Strata		-.253	
Intercept	-3.616	-3.934	-3.803
-2 Log Likelihood	2026.36	2023.34	2023.89
Degrees of Freedom	4	7	6

\* indicates statistical significance when  $\alpha = .1$

Before testing the incentive-related hypotheses, I note some consistencies with regard to census and stratification expectations as well as earlier results. First, the significance of the stratum

term in the Simple Model in Table 5 confirms expectations that census response is lower in low coverage areas than high coverage areas. With regard to incentive and response mode findings, tests of parameter estimates in the Simple Model confirm that CATI obtains higher response than the Internet and ASQ while controlling for the incentive treatment, and that the incentive effect holds while simultaneously controlling for response mode and stratum.

#### 4.2.1 Incentive-Strata Interaction

The Incentive-Strata Model in Table 5 is formed to determine if the incentive is more effective in increasing response in low coverage areas (high Black and Hispanic and renter concentration) compared to high coverage areas. A significance test of this interaction (Incentive\*Strata = -.253) indicates that the effect of the incentive on response is not significantly different between high and low coverage areas, while statistically controlling for response mode. This finding contradicts the initial hypothesis and past literature of a more pronounced incentive effect among lower SES populations compared to other populations (Kulka,1994; Singer,forthcoming) and therefore merits further investigation. Table 6 below shows the effect of the incentive on mode specific response within and across modes for each stratum population.

**Table 6. Response Rates, Sample Sizes, and Response Rate Differences between Incentive and No Incentive Groups within and across Response Modes in High and Low Coverage Areas**

Mode	High Coverage Areas			Low Coverage Areas		
	Mode Specific Response Rate		Difference	Mode Specific Response Rate		Difference
	Incentive	No incentive		Incentive	No incentive	
CATI	9.9% (628)	7.3% (579)	2.6%	6.1% (247)	5.0% (202)	1.1%
ASQ	6.8% (547)	3.7% (593)	<b>3.1%*</b>	5.3% (206)	2.4% (209)	2.9%
Internet	4.5% (645)	4.4% (631)	.1%	2.3% (222)	.5% (219)	<b>1.8%*</b>
Total	7.0%	5.1%	<b>1.9%*</b>	4.6%	2.6%	<b>2.0%*</b>

\* indicates statistical significance when  $\alpha=.1$ .

In accordance with the logistic results, both strata show an overall incentive effect of roughly the same magnitude (1.9% for HCA versus 2.0% for LCA) contrary to expectations based on past research (Kulka,1994; Singer,forthcoming). There are at least two possible reasons for this discrepancy. First, stratum, while a good indicator of census response, is based on 1990 tract level data and may not be a suitable proxy variable for SES. Limited data on nonrespondents

make it impossible to test this theory. Secondly, legality and sponsorship differences between the U.S. decennial census and surveys may explain this discrepancy. Certain people, such as illegal immigrants and fugitives, may deliberately avoid the census. If low coverage areas contain a higher concentration of these people than high coverage areas, it is possible that these results reflect that fact that the incentive does not increase response from those who are intentionally avoiding the census.

#### 4.2.2 Incentive-Mode Interaction

Until this point, the incentive effect has been discussed without regard to response mode. The Incentive-Mode Model in Table 5 is formed to allow comparisons of the incentive effects across the three modes. Recall that larger effects were expected in ASQ compared to CATI due to the absence of an interviewer as a motivator. Significance tests of the interaction parameters in the Incentive-Mode Interaction Model suggest that the increase in mode specific response due to the incentive is not significantly different between ASQ and CATI ( $CATI * Incentive = -.364$ ). The effect of the incentive in the Internet mode is significantly lower than ASQ, but is not significantly different from the effect in CATI as determined by a test for a difference in the interaction parameters ( $p=.556$ ). The lack of a differential incentive effect between the self-administered and CATI modes may be due to the fact that the call to participate is respondent-initiated in each mode and therefore, the interviewer only acts as a motivator in CATI once the respondent has decided to cooperate.

#### 4.3 Incentive Effect on Response Distribution

Finally, logistic regression coefficients in Table 7 allow an assessment of the effect of the incentive on the demographic distribution of mail, CATI, ASQ, and Internet respondents. Specifically, this regression model includes all respondents, regardless of their experimental panel assignment, in an attempt to determine which factors are associated with households that performed the prescribed behavior to receive the incentive.



**Table 7. Logistic Regression Coefficients Predicting the Log Odds of Receiving the Incentive Among Respondents**

<b>Factor</b>	<b>Model</b>
Age of Person 1	<b>-.015*</b>
Person 1 Black = 1	.239
Person 1 Hispanic = 1	-.030
Renter-occupied Household = 1	.188
High Coverage Area = 1	-.067
Female = 1	.031
Household Size	-.091
Intercept	-.043
-2 Log Likelihood	729.20
Degrees of Freedom	7

\* indicates statistical significance when  $\alpha = .1$

The model suggests that Person 1 in households receiving the incentive tends to be younger than Person 1 in households not receiving the incentive, where the odds of receiving the incentive decrease by 7.2% for each 5-year increase in the age of Person 1. This finding may suggest that the incentive is more attractive to younger persons. Conversely, since the incentive was only activated for those who tried a new response mode, perhaps younger people are more likely to use new technology. It is impossible to control for the effects of mode in this study given that an alternative mode response was required in order for a household to receive the incentive. An age comparison of mail and electronic mode respondents reveals that mail respondents are on average older (50.4) than electronic mode respondents (42.1), suggesting that the proposed incentive effect on younger people may be due to more willingness to try a new mode<sup>9</sup>. Otherwise, while controlling for age, sex, and households size there is no evidence to suggest that incentives disproportionately recruit non-whites or renters<sup>10</sup>.

#### 4.4 Overall Findings

<sup>9</sup> No significant factors were found when the model included only electronic mode respondents.

<sup>10</sup> The race and ethnicity variables are not significantly different from zero when simultaneously compared. Moreover, these findings do not change when strata or household size is omitted from the model.

It is interesting to note that the increase in mode specific response due to the incentive is significant when the three response modes are combined, yet the effect of the incentive is diminished when overall response to the second mailing is considered in Table 4, except for ASQ. This finding suggests that the incentive merely causes response to be redirected to alternative modes rather than encourage response to the census. It is unclear as to why this finding is not replicated in the ASQ mode. Empirical tests of the ASQ system led to observations that the system is generally difficult to use and time consuming. Perhaps those who were offered the ASQ phone number threw away their paper questionnaires in hopes of using the telephone to complete the form. Upon calling the system and determining that response to a machine rather than a live interviewer was required, perhaps respondents who did not receive the incentive were not motivated to work through the system difficulties. This suggestion is merely speculative and there is no data to support or disconfirm this theory.

From a Nonresponse Followup perspective, it is quite notable that around 13% participation (see Table 4) was obtained from cases that did not initially return the questionnaire, especially since replacement questionnaires were not included in the second mailing. Since approximately 4 to 6 percent of people responded using an alternative mode (see Table 4), around 6 to 9 percent returned the questionnaire that was included in the initial March mailing. This finding suggests that a second mailing containing a request for census participation may in itself be a method for increasing participation in the census as well as lowering the amount of costly personal interviews. Past census tests indicate that followup letters both with and without replacement questionnaires can be effective at increasing response (see Dillman *et. al.* (1994), Memorandum from Leslie through Killion to Thompson (1997)).

## **5. RECOMMENDATIONS**

Examination of the response mode alternatives reveals that CATI obtains the highest level of response compared to ASQ and the Internet. It should not be inferred from this paper that the people prefer CATI over the Internet for data collection. Internet accessibility limitations among the population in this experiment confound the response rate comparisons among the modes. As Internet access continues to span the United States population, experiments testing the feasibility of this method for census data collection should continue to be tested.

Consistent with past findings, the use of an incentive in this experiment increases response to the alternative modes; however, the effects disappear when total response to the second mailing is examined. Therefore, the incentive in this experiment is successful in transferring response that would have otherwise been obtained by mail to a different mode, but not in recruiting households with no intention of responding.

In contrast to past incentive literature, there is no evidence of increased incentive effects within areas of low census coverage (with high proportions of non-whites and renter units) compared to high coverage areas, which may be due to the fact that coverage area is not a good proxy for SES. Moreover, there is no evidence that incentives are more powerful at increasing response in the absence of an interviewer as a motivator. It is possible that ASQ difficulties as well as

Internet accessibility issues confound the incentive effect within each mode. Moreover, the interviewer was only a motivating source in keeping the respondent from discontinuing the interview, since the initial contact was respondent-initiated. Perhaps incentives would prove to be most effective in the self-administered modes if the cases assigned to the CATI mode were contacted directly by the interviewer as in a traditional survey setting.

Comparisons of respondent demographics reveal that the incentive seems to attract younger respondents; however, this finding is confounded with the influence of the alternative response mode options. There is some evidence to suggest that younger persons may be influenced by the chance to use a new mode.

Taken together, the results provide some guidance for future decennial censuses. Due to the extremely low response rates in this study, it is clear that incentives and response mode options are not effective tools for increasing response among typical census nonrespondents. The incentive, while somewhat effective in directing response to a particular mode, has no overall effect on total response to the census. Moreover, the response mode comparisons in this study are confounded due to Internet access limitations as well as ASQ system technology limitations. Therefore, the recommendation is for further testing in the years before the 2010 census. As Internet access spreads and technology advances, this mode may quickly become a time efficient way of responding to the census.

Aside from any effect of the experimental treatments, it may be worthwhile to investigate the effect of sending a second census request to households failing to answer the first request since 13% participation was gained from the use of a second mailing only (see Table 4). Although there is no evidence that this technique could potentially replace the personal/telephone interviews, it may successfully lower the number of cases that need to be followed up using the expensive approaches.

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